Fighting the need for speed

Advanced driver assistance systems are becoming increasingly common in automobiles. While they're supposed to help keep motorists safe, they could also be encouraging them to engage in risky behaviour.

This is what BioMechanical Design student Timo Melman learned while conducting research on the systems (which are often referred to as ADAS) for his MSc thesis. He focused on a newer one called haptic steering guidance that uses assistive forces to help keep drivers within their lane on windy roads. Melman discovered that, while this ADAS is designed to improve their driving, it often encourages them to speed as well.

As with similar systems, this system causes what's called adverse behavioural adaptation. Drivers tend to become overly reliant on them, which leads to them engaging in counter-intuitive activities that can be quite dangerous. In the case of haptic steering guidance, drivers start putting the pedal to the metal. "There are many different psychological theories that try to explain why people show behavioural adaptation, such as speeding," Melman said. "Why people adapt in such a way remains difficult to explain because it depends on many other factors like personality, driver experience, the driver's attitude towards the ADAS and, of course, on the design of the ADAS."

Melman spent nine months working on the project and took a close look at driver simulator studies that have been conducted on haptic steering guidance. In one test, drivers who continually used the system on a 13.9 km road with curves drove, on average, 7 km/h faster than those who did not. Melman also collaborated with his colleagues and supervisors in the HFauto Project and the Symbiotic Driving Project and developed two systems that provide the benefits of haptic steering guidance without causing drivers to speed.

"I fully agree and believe that if we take these negative adaptations into account, we will be able to develop safer man-machine systems," Melman said. (BH)

Melman, T., Does Haptic Steering Guidance Instigate Speeding?, Supervisors: Dr. D.A. Abbink and Dr. J.C.F. de Winter, Defence: June 3, 2016

The world's first bio-laser and bio-lens made in Delft

How do you make a bio-laser and a bio-lens out of bacteria? A team of ten TU Delft students will work through the summer to make these ideas into reality. The ultimate goal is to win the International Genetically Engineered Machine (iGEM) competition, the biggest in synthetic biology.

As nine of the ten members are women, the iGEM team forms an exceptional group of students considering the number of men at TU Delft. They will compete in Boston with 300 other teams from all around the world. Participants have to solve a societal problem using microorganisms by giving them a special property. The TU Delft team uses the DNA of jellyfish and sea sponges to make their microorganisms into extraordinary beings.

The TU Delft group focuses on bio-optics, which is important for visualising and understanding a cell. The light inside a cell is tracked with bio-optics, thereby exposing the cell's mechanisms. Existing technologies that use fluorescence are good, but not good enough. Therefore, the team wants to design a bio-laser to provide sharper images. In this way, diseases like cancer can be tracked. But the team is up to more challenges. Based on the bio-laser idea, they will also design a bio-lens. This could be used as a camera for smartphones or as a coating in solar panels to increase efficiency.

And believe it or not, these innovative plans will be carried out by bacteria. DNA originating from a sea sponge is inserted in the bacteria, which will ensure production of protein. This particular protein can make a bacterium build a thin layer of glass around itself. The result is a tiny glass ball with a bacterium inside. One of the challenges the team has to deal with is the removal of the bacterium. The remaining ball of glass is then nothing more than a tiny lens.

'We receive help but it's mostly our own design and creation'

If another piece of DNA is inserted, like the one from the jellyfish, the cell will make fluorescent proteins, meaning that they can emit light. By combining the glass-making protein with the light-emitting protein, they can ensure that light emitted by the cell will be reflected multiple times in the glass before leaving the bacterium. This builds up the energy and a small bundle of light, or laser, will be the result.

If the TU Delft iGEM team succeeds, they will have made the world's first bio-laser and bio-lens which operate in an independent way. "It is a unique project," said Célina Reuvers. "We receive help from PhD students and professors, but it's mostly our own design and creation." The team will present their project in Boston in October of this year. (AS)